

REMARKS

The Applicants respectfully request further examination and favorable consideration in view of the amendment set forth above and the remarks set forth below. Claims 1-25 and 29-30 were pending. Within the Office Action, claims 1-25 and 29-30 were rejected under 35 U.S.C. § 112 first paragraph, as well as under 35 U.S.C. § 103. Claim 23 has been amended. Claims 1-25 and 29-30 are now pending.

The Applicants attach the Declaration of Dr. Mehrdad Moslehi Under 37 C.F.R. § 1.132 to Overcome Rejections Under 35 U.S.C. § 112 ¶ 1 and 35 U.S.C. § 103 ("Moslehi Decl.") in support of the following arguments.

Information Disclosure Statements

The Examiner stated that the information disclosure statement filed April 23, 2001, failed to comply with 37 C.F.R. 1.98(a)(2). The Examiner stated that the Information Disclosure Statement Paper No. 4 and the documents were missing. The Examiner further stated that Information Disclosure Statement Paper No. 5 foreign publication and other documents were also missing.

The Applicants have attached IDS Paper No. 4, its documents, and IDS Paper No. 5 and respectfully request that they be considered.

Rejections Under 35 U.S.C. § 112, first paragraph

The Examiner rejected claims 1-25 and 29-30 under 35 U.S.C. § 112, first paragraph, stating that the claims contain "subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, the applicant has not disclosed the structural requirements for high pressure, seals and fittings and fixturing for work piece holding needed for connecting the super critical module to the transfer module."

The Applicants respectfully traverse the Examiner's rejection. The law is clear that "[t]he question is whether the disclosure is sufficient to enable one skilled in the art to practice the claimed invention[;] hence the specification need not disclose what is well known in the art." *Lindemann Maschinenfabrik GMBH v. American Hoist and Derrick Co.*, 730 F.2d 1452, 1463 (Fed. Cir. 1984). Indeed, a disclosure can be enabling even if some experimentation is required to practice the claimed invention. *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1557 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

When the present application was filed, one skilled in the art could read the disclosure and practice the claimed invention. As Dr. Moslehi, a person skilled in the art [Moslehi Decl. ¶¶ 2-11] states:

On the filing date (November 1, 2000), a person who was skilled in the art and had read the '641 patent application would have known the structural requirements for making the high-pressure process chambers (pressurized vessels) disclosed in the '641 patent application. After reading the '641 patent application the person would know how to choose and assemble the seals, fittings, and workpiece fixturing that form the process chambers and cluster tool described in the '641 patent application. To do this, one skilled in the art needs only the operating pressure and temperature ranges, as are disclosed, for example, at pages 9-10 of the '641 patent application.

[Moslehi Decl. ¶ 23]

Dr. Moslehi further explains that on the filing date there existed processing chambers that, while not configured to perform supercritical processing, were capable of withstanding the temperatures and pressures required for supercritical processing. *Id.*, ¶¶ 24-25. With this and other knowledge known to those skilled in the art on the filing date, one would have known what sealings, fittings, and fixtures to construct the apparatus recited in claim 1. *Id.*, ¶ 25.

Because, on the filing date, one skilled in the art would have known how to practice the invention of the present application after reading the complete application, the application complies with 35 U.S.C. § 112 ¶ 1. Accordingly, the Applicants respectfully request that the Examiner withdraw the rejection.

Rejections Under 35 U.S.C. § 103

The Examiner rejected claims 1-10, 13, 15-17, 19-25, and 29 under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 6,110,232 to Chen *et al.* (Chen) in view of U.S. Patent No. 5,979,306 to Fujikawa *et al.* (Fujikawa). With regard to claim 1, the Examiner states that Chen discloses a transfer module having modules used for non-supercritical processing. The Examiner further states that Fujikawa "discloses a module *capable* of doing supercritical processing" (*italics added*). The Examiner concludes that "it would have been obvious to one having ordinary skill in the art to couple the supercritical module to the transfer module of Chen *et al.* to combine [the] supercritical processing step with other processing on a wafer without taking the wafer out of [a] clean environment between steps."

The Applicants respectfully traverse the Examiner's rejection. As Dr. Moslehi describes in his attached declaration, after reading Fujikawa and Chen, one of ordinary skill in the art would have found no motivation, teaching, or suggestion to combine the teachings of Fujikawa and Chen to produce the cluster tool recited in claim 1. [Moslehi Decl. ¶ 30]

"Fujikawa . . . discloses a stand-alone high-pressure/high-temperature (so-called heating pressure) process chamber." [Moslehi Decl. ¶ 18] While briefly mentioning supercritical processing (Fujikawa, col. 1, lines 9-10), Fujikawa does not teach how to perform supercritical processing or how to attach a supercritical processing module to a non-supercritical processing module. Nor does Fujikawa teach the process steps that would be required to perform supercritical processing alone, or to combine supercritical and non-supercritical processing in a cluster tool. [Moslehi ¶ 18]

Chen discloses a processing system that includes a degas chamber for removing etch residues from a wafer before transferring the wafer to a load-lock chamber that could be corroded by the etch residues. Chen discloses an apparatus that functions at or near vacuum. [Moslehi ¶ 19] Chen does not teach a cluster tool or a supercritical processing chamber. *Id.*

In view of Dr. Moslehi's declaration, it would not have been obvious to combine Fujikawa and Chen to produce the cluster tool as recited in claims 1 and 29. As Dr. Moslehi states:

Such an integration of two processing modules with substantially different operating pressure regimes (the supercritical module operating at tens to well over 100 atmospheres while the non-supercritical module operating at sub-atmospheric and/or near-vacuum pressures) on a common transfer module requires identifying the supporting integrated process sequences that would benefit from such a cluster integration. The '641 patent application has clearly identified and disclosed such cluster-integrated process applications (for instance, etching the wafer in an etch module, stripping the photoresist and/or cleaning the wafer in a supercritical CO₂ cleaning module, and then depositing a metal layer in a non-supercritical metal deposition module). Moreover, the integration of such vastly different processing modules operating at substantially different pressure regimes on a common transfer module requires taking special precautions and utilizing features to eliminate the possibility of cross-contamination and gas leakage from the supercritical processing module to the nonsupercritical processing module(s) while achieving high processing throughputs.

[Moslehi Decl. ¶ 28]

Such precautions and features would not have been obvious to someone skilled in the art on the filing date. The '641 patent application clearly discloses the required apparatus (e.g., Figure 5) and supercritical processing method (e.g., Figure 3) to enable such high-throughput cluster integration of the supercritical processing module with non-supercritical processing modules on a common transfer module. On the filing date, one skilled in the art would not have tried to integrate Fujikawa's heat-pressure processing apparatus with Chen's vacuum-integrated cluster tool, without a knowledge of the required supercritical processing apparatus design features (Figure 5) and operating sequence (Figure 3) disclosed in the '641 patent application. Such an attempt would certainly fail due to massive cross-contamination and leakage problems.

Id., ¶ 29.

Dr. Moslehi found that there was no suggestion, motivation, or expectation of success to combine Fujikawa and Chen. *Id.*, ¶ 30. Accordingly, one skilled in the art would not have combined Fujikawa and Chen to produce the apparatus recited in claim 1, claim 1 distinguishes over the combination of Fujikawa and Chen and is therefore allowable. Because claims 2-25 depend from claim 1, they are allowable for the same reasons that claim 1 is allowable.

The Examiner further rejected claim 18 as being unpatentable over Chen, in view of Fujikawa and Jevtic (U.S. Patent No. 5,928,389). The Examiner stated that "Chen et al. does not disclose an antechamber coupling the transfer module and the supercritical process module. Jevtic discloses a combination of a process chamber and an additional robot adapted to be disposed between the transfer chamber connected to the load locks and one or more process chambers which could be the supercritical module." The Examiner added parenthetically that "Figure 1 112 [of Jevtic] could act like the ante chamber robot and any one of the process modules around it could be a supercritical module."

The Applicants respectfully traverse the Examiner's rejection. In accordance with one embodiment of the present invention (*see, e.g.*, Specification page 7, line 29 to page 8, line 8), the antechamber is pressurized with carbon dioxide before the workpiece is transferred from it to the supercritical processing module; after the workpiece is processed, the workpiece is returned to the antechamber, which is evacuated by a vacuum pump. The workpiece can now be transferred to another processing chamber. In this embodiment, the antechamber is thus small enough to be pressurized and depressurized quickly, allowing high throughput. Moreover, the antechamber is described as being configured to be pressurized with carbon dioxide (page 7, line 31-32) and also configured to be evacuated by a vacuum pump (page 8, lines 2-3).

The transfer chamber (Figure 1 112) in Jevtic does not have the same structure as the ante-chamber recited in claim 18 of the present invention. Dr. Moslehi states, it would not have been obvious to one skilled in the art to combine Fujikawa, Chen, and Jevtic to produce the apparatus recited in claim 18.

The assumption is that the transfer chamber 112 illustrated in Figure 1 of Jevtic can function as an antechamber. This assumption would not have been obvious to one skilled in the art for a number of reasons. First, the Applied Materials Endura system in Jevtic is a staged vacuum cluster tool system and there is no mention of using the second handler as an antechamber for supercritical processing modules. An ante-chamber or buffer/isolation chamber as outlined in the '641 patent application is a very small volume chamber connected to only one supercritical processing module on one end, while connecting to the transfer chamber on the other end. The requirement of a small volume is essential for maximizing throughput and minimizing cross-contamination between the supercritical processing module and other non-supercritical processing modules. The transfer chamber 112 in Jevtic (Endura's staged vacuum central wafer handler) fundamentally does not meet the requirements for a supercritical processing ante-chamber since (a) it has a very large volume, (b) it has multiple access ports, and (c) it does not meet the low-volume requirement for fast throughput and negligible cross-contamination. Thus, on the filing date, it would not have been obvious to one skilled in the art to combine Jevtic, Chen, and Fujikawa to produce a cluster tool having supercritical modules, non-supercritical modules, and an ante-chamber since the resulting outcome falls far short of meeting the intended requirements (reduced cross-contamination and increased throughput). If one skilled in the art used Jevtic's cluster tool and attached Fujikawa's processing system to it by using the staged transfer chamber as an ante-chamber, the combined system would not be practical for manufacturing applications.

Id., ¶ 32.

Because one skilled in the art would not have combined Fujikawa, Chen, and Jevtic to produce the apparatus recited in claim 18, claim 18 is non-obvious and accordingly is allowable over the cited prior art.

The Examiner further rejected claim 20, stating that "it pertains to an intended use well known in the art . . . and does not structurally distinguish over Fujikawa." The Applicants respectfully traverse the Examiner's rejection. Claim 20 recites, in part, "wherein the means for pressurizing comprises a CO₂ pressurizing configuration which comprises a CO₂ supply vessel coupled to a pump which is coupled to the supercritical processing module." This language recites structure, not intended use. The Applicants traverse the Examiner's rejection on the

additional grounds that claim 20 depends from claim 1 and is therefore allowable for the same reasons that claim 1 is allowable.

The Examiner further rejected claims 23-24, stating that “[c]laims 23-24 pertain to intended use and do not structurally distinguish over Chen et al. Chen et al’s apparatus however, provides means for injecting inert gas like nitrogen *which could allow* the pressure in the transfer chamber to be slightly positive (Col 2 line 22-25)” (emphasis added).

In response to the Examiner’s rejection based on intended use, the Applicants have amended claim 23 to now recite structure. Claim 23 now recites “means for maintaining a pressure in the transfer module configured to be a slight positive pressure relative to a surrounding environment.” Claim 23 now recites how the claim element is configured and thus recites acceptable structure.

The Examiner further rejected claim 23 on the grounds that it could be configured to “allow the pressure chamber in the transfer chamber to be positive.” The Applicants respectfully traverse this rejection. The law is clear that prior art cannot merely be capable of being modified to support a § 103 rejection. Indeed, there must be some suggestion, motivation, or teaching to modify the prior art to produce the claimed invention. *See, e.g., In re Mills*, 916 F.2d 680, 682 (Fed. Cir. 1990) (“While [the prior art] apparatus may be capable of being modified to run the way Mills’ apparatus is claimed, there must be a suggestion or motivation in the reference to do so.”) The Examiner points to no suggestion, motivation, or teaching in Chen which would allow the pressure in the transfer chamber to be slightly positive.

In contrast, the Specification, at page 12 lines 20-26, describes the advantage of this structure, an advantage neither taught nor suggested in the prior art:

Rather, the transfer module 72 operates at atmospheric pressure or at a slight positive pressure relative to the surrounding environment where the slight positive pressure is produced by an inert gas injection arrangement. The inert gas injection arrangement injects an inert gas, such as Ar, CO₂, or N₂, into the transfer module 72. This assures a cleaner processing environment within the transfer module 72 if the transfer module is not operated at vacuum.

Accordingly, for this additional reason, claim 23 is allowable over Fujikawa and Chen. Because claim 24 depends from claim 23, it too is allowable for this additional reason.

The Examiner rejected claim 30, as being unpatentable over Maydan et al. (U.S. Patent Number 5,882,165) in view of Fujikawa. The Examiner stated that "Maydan discloses a hand off station (Fig 1-14), several non-supercritical modules coupled to the hand off station, a transfer mechanism configured to move the work piece between the entrance and the modules coupled to it. Maydan et al does not disclose a supercritical module coupled to the hand off station. Fujikawa et al discloses a module capable of doing supercritical processing (Col 1 line 9-14). Therefore it would have been obvious to one having ordinary skill in the art to couple the supercritical module to the transfer module of Chen et al [read, Maydan et al] to combine supercritical processing step with other processing on a wafer without taking the wafer out of clean environment between steps."

The Applicants respectfully traverse the Examiner's rejection. Maydan discloses a vacuum-integrated cluster tool that is incapable of performing supercritical and non-supercritical processing. [Moslehi Decl. ¶ 33] As Dr. Moslehi explains:

The combination of Maydan's cluster tool and Fujikawa's heat pressure processing system also falls far short of the claimed cluster integrated system comprising supercritical processing and non-supercritical processing modules. A direct integration of Fujikawa's heat pressure processing system on Maydan's cluster tool will not provide the result produced by the apparatus recited in claim 30 of the '641 patent application. Again combining a supercritical processing module and a non-supercritical processing module on a cluster tool platform would not have been obvious to one skilled in the art on the filing date without the process integration drivers being identified, as in the '641 patent application. The combination of Maydan and Fujikawa does not teach how to perform supercritical cleaning or how to conduct a sequence of supercritical and non-supercritical process steps. Without a knowledge of the process apparatus of Figure 5 and the process sequence in Figure 3 of the '641 patent application, the combination of Maydan and Fujikawa on a cluster platform would fail; the cluster tool disclosed by Maydan would not operate properly in combination with Fujikawa's system and there would be massive cross-contamination and leakage between different modules. The cluster tool would simply fail and not operate properly.

[Moslehi Decl. ¶ 33]

Dr. Moslehi concludes that on the filing date, one of ordinary skill in the art would have had no suggestion, motivation, or expectation of success to combine Maydan and Fujikawa. Accordingly, claim 30 is non-obvious over the cited prior art and accordingly is allowable.

CONCLUSION

For the reasons given above, the Applicants respectfully submit that claims 1-25 and 29-30 are distinguishable over the cited references and are in condition for allowance. Allowance at an early date would be appreciated. If the Examiner has any questions or comments, he is encouraged to call the undersigned at (408) 530-9700 so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
HAVERSTOCK & OWENS LLP

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